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IS : 9713 - 1983
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Indian Standard
SPECIFICATION FOR HOT-ROLLED ELECTROLYTIC COPPER WIRE RODS FOR ELECTRICAL CONDUCTORS

(First Revision)

First Reprint DECEMBER 1997

UDC 669.337-426-122.4 : 621.315.55

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BUREAU OF INDIAN STANDARDS
MANAK BHAVAN. 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

Gr 2 *February* 1984

Indian Standard

SPECIFICATION FOR HOT-ROLLED ELECTROLYTIC COPPER WIRE RODS FOR ELECTRICAL CONDUCTORS

(First Revision)

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Indian Standard

SPECIFICATION FOR HOT-ROLLED ELECTROLYTIC COPPER WIRE RODS FOR ELECTRICAL CONDUCTORS

(First Revision)

0. FOREWORD

0.1 This Indian Standard (First Revision) was adopted by the Indian Standards Institution on 3 December 1983, after the draft finalized by the Copper and Copper Alloys Sectional Committee had been approved by the Structural and Metals Division Council.

0.2 Hot-rolled electrolytic copper wire rods are used in copper wire drawing industry as drawing stock for electrical conductors. The quality of copper wire depends upon the quality of the hot rolled copper wire rods.

0.3 This standard was first published in 1980. As a result of experience gained, the Sectional Committee decided to revise the standard. In this revision the following modifications have been made:

a) Tolerances on diameter and mechanical properties have been modified.

b) Clauses on chemical composition, sampling and criteria for conformity and packing and marking have been modified.

0.4 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS : 2-1960*. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

1. SCOPE

1.1 This standard covers the requirements of the hot-rolled electrolytic copper wire rods used as drawing stock for electrical conductors.

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*Rules for rounding off numerical values (*revised*).

1.2 The wire rods shall be round in section having diameter up to 18 mm.

2. TERMINOLOGY

2.0 For the purpose of this standard, the following definition as given in IS : 3288 (Part 1)-1981* shall apply.

2.1 Wire Rod — Rodlike product of uniform cross section exceeding 6 mm diameter obtained by casting and rolling or extrusion used as intermediate product for further processing, may be supplied in straight length or coils.

3. GENERAL REQUIREMENTS

3.1 General requirements relating to the supply of material shall conform to IS : 1387-1967†.

4. CHEMICAL COMPOSITION

4.1 The material shall have chemical composition of ETP copper as given in IS : 191 (Part 5)-1980‡.

4.2 The chemical composition shall be determined by the method specified in IS : 440-1964§ or any other established instrumental/chemical method. In case of dispute, the procedure specified in the latest edition of IS : 440§ for chemical analysis shall be the referee method.

4.3 The method for determination of oxygen shall be as agreed to between the supplier and the purchaser.

5. DIMENSIONS

5.1 The diameter shall be measured by the method as given in **5.1.1.**

5.1.1 Discard approximately 2·5 metres length from the end of the coil. Measurement shall be made with accuracy better than 0·01 mm The spindle and anvil of micrometer shall have a diameter of 5 to 8 mm The measurement shall be made with a pressure of 1 to 3 MPa.

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*Glossary of terms for copper and copper alloys : Part 1 Cast form and wrought from (main types) (*second revision*).

†General requirements for the supply of metallurgical materials (*first revision*).

‡Specification for copper : Part 5 Electrolytic tough pitch copper (ETP) (*third revision*).

§Methods of chemical analysis of copper.

5.2 Tolerances

5.2.1 The tolerance on diameter of wire rods shall be as given in Table 1. Three measurements at 60° angular displacement shall be made around circumference at two places 4 metres apart. An average of six readings shall be considered as the diameter of the wire rod. No individual reading should exceed the tolerance limit. Any special tolerance on diameter shall be as agreed between the purchaser and the supplier.

TABLE 1 TOLERANCE ON DIAMETER

All dimensions in millimetres.

DIAMETER		TOLERANCE
Over	Up to and Including	
6	9	± 0·5
9	12	± 0·7
12	18	± 0·9

5.2.2 *Ovality of the Conductor* — The measurement shall be carried out in accordance with **5.1**. Ovality shall not be more than 100 percent of the tolerance. Measurement shall be done at two places 4 metres apart. At each point, 4 readings at 45° to each other shall be taken. Ovality shall be measured by obtaining the difference in a pair of readings taken at 90° to each other. The maximum difference obtained at each point shall be termed as the maximum ovality.

6. FREEDOM FROM DEFECTS

6.1 The surface of rolled wire rod shall be fairly smooth, free from inclusions or foreign particles, indentation, surface defects, twists, entanglement, etc.

7. MECHANICAL PROPERTIES

7.1 Tensile Requirements — When tested in accordance with IS : 2654-1977* for tensile strength and elongation, the material shall meet the requirements of Table 2.

8. SURFACE TEST

8.1 Compression Test — The test shall be carried out as given in **8.1.1**. The curved surface, after test, shall not show any crack or defect on the surface when viewed with normal vision.

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*Method for tensile testing of copper and copper alloys (*first revision*).

8.1.1 A sample from a rolled coil of length twice the diameter of the wire rod is to be cut and then hammered till its length becomes half the original length.

TABLE 2 MECHANICAL PROPERTIES

(*Clause* 7.1)

Diameter		Tensile Strength, *Min*	Elongation on Gauge Length of 250 mm, *Min*
Over mm	Up to and Including mm	MPa	Percent
6	9	210	32
9	12	205	40
12	18	200	46

Note — 1 MPa = 1 MN/m^2 = 1 N/mm^2 = 0·102 kgf/mm^2.

9. SAMPLING AND CRITERIA FOR CONFORMITY

9.0 Unless otherwise agreed between the purchaser and supplier the following sampling procedure and criteria for conformity shall hold good.

9.1 Lot — In a consignment, all the wire rods of the same size, manufactured from the same raw material under similar conditions of production shall be grouped together to constitute a lot.

9.2 The number of wire rods to be selected from each lot shall depend upon the number of wire rods in a lot and shall be in accordance with col 1 and 2 of Table 3.

TABLE 3 SAMPLE SIZE AND PERMISSIBLE NUMBER OF DEFECTIVES

Number of Wire Rods in a Lot (1)	Number of Wire Rods in the Sample (2)	Permissible Number of Defectives (3)	Number of Wire Rods for Chemical Analysis, Mechanical Properties and Surface Test (4)
Up to 50	8	0	1
51 to 100	13	1	2
101 to 150	20	1	3
151 to 300	32	2	4
301 to 500	50	3	5
501 to 1 000	80	5	6

9.3 The wire rods selected at random according to col 1 and 2 of Table 3 shall be examined for freedom from defects and for dimensions and tolerances. Any wire rod failing to satisfy any of these requirements shall be considered as defective. If the number of defectives found in the sample is less than or equal to corresponding permissible number given in col 3 of Table 3, the lot shall be considered as conforming to these requirements.

9.4 The lot which has been found satisfactory with respect of dimensional requirements and freedom from defects shall next be tested for chemical analysis, mechanical test and surface test (compression test). For this purpose, the number of wire rods as given in col 4 of Table 3 shall be taken. These may be taken from those wire rods examined under **9.3** and found satisfactory. From each of the wire rod so selected, three test specimen, one for chemical analysis, second for mechanical tests and third for surface test shall be prepared and tested.

9.4.1 If the test results of chemical analysis as obtained for each of the elements satisfy the corresponding requirements, the lot shall be considered as conforming to the chemical composition requirements of the specification.

9.4.2 Lot shall be considered as conforming to the requirements of the mechanical properties and surface if all the test results on the different samples satisfy the corresponding requirements.

9.5 Retest — If the test results of chemical analysis fails to satisfy the requirement for any element, two more tests for that element shall be done on the same sample in order to confirm that the analysis has been done properly. If both the test results satisfy the relevant requirements the lot shall be considered as conforming to the specification, otherwise not.

9.5.1 If the test results on any sample for mechanical test and surface test, fail to satisfy the requirements for any of the mechanical properties or show any crack or defect in surface test, two more tests shall be done on samples collected from the same lot. If both the test results satisfy the relevant requirements, the lot shall be considered as conforming to the specification, otherwise not.

10. PACKING

10.1 The material shall be supplied in bundles or coils, strapped with loops or as required by the purchaser.

11. MARKING

11.1 Suitable tags with marking made on them to show the name or trade-mark of the manufacturer, size of wire rod, its lot number, date of manufacture, mass and any such information required by the purchaser, shall be attached with each bundle/coil of the material.

11.1.1 The material may also be marked with the Standard Mark.

11.1.2 The use of the Standard Mark is governed by the provisions of Bureau of Indian Standards Act, 1986 and the Rules and Regulations made thereunder. The details of conditions under which the licence for the use of Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.

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Printed at Dee Kay Printers, New Delhi-110015, India.